### THUNDER-STORMS.

The accompanying table shows that thunder-storms were most frequently reported during the month in Florida, where their occurrence was noted on twenty-four days, and that no thunder-storms were observed in Maine. In New York, Iowa, Kansas, and Arizona they were reported on fifteen days; in the District of Columbia, New Hampshire, Rhode Island, and Idaho, on one day only; while in Vermont, Connecticut, Massachusetts, Maryland, Virginia, West Virginia, Indiana, Louisiana, Montana, Utah, New Mexico, Washington Territory, and Wyoming they were observed on less than five days. In California they were reported on thirteen days. They occurred in the largest number of states and territories (twenty-three) on the 13th; in nineteen on the 20th, and in from ten to eighteen, inclusive, daily from the 1st to the 12th, and on the 14th, 15th, 16th, 18th, 19th, 21st, and 22d. During each of the last eight days of the month they were observed in less than ten of the states and territories, the dates of their minimum occurrence being the 23d and 24th. As there are no stations of observation in Delaware, no reports of thunder-storms have been received from that state.

*Table showing the number of stations in the several states and territories reporting thunder-storms for each day during September*, 1888.

| State or Territory. | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. | 16. | 17. | 18. | 19. | 20. | 21. | 22. | 23. | 24. | 25. | 26. | 27. | 28. | 29. | 30. | 31. | Total No. of days. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alabama | 1 | 1 | 1 | 1 | 1 | 2 | 1 | .... | 1 | .... | 1 | .... | 2 | 2 | .... | .... | .... | .... | .... | .... | .... | 2 | 2 | .... | .... | .... | .... | .... | .... | .... | .... | 13 |
| Arizona | 1 | 3 | 2 | 1 | 2 | 2 | .... | 1 | .... | .... | .... | .... | .... | .... | 2 | .... | 2 | 5 | 1 | .... | .... | 3 | .... | .... | 1 | .... | 1 | .... | .... | 1 | .... | 15 |
| Arkansas | .... | .... | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | 1 | 1 | .... | .... | .... | .... | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 4 |
| California | .... | 1 | 2 | 1 | .... | .... | .... | .... | .... | 1 | 3 | .... | .... | 9 | 6 | 4 | 3 | .... | .... | .... | .... | 1 | .... | 1 | 2 | .... | .... | 1 | .... | .... | .... | 13 |
| Colorado | 4 | .... | .... | .... | .... | 1 | .... | .... | .... | 1 | 3 | .... | 1 | .... | .... | .... | .... | 4 | 3 | .... | 2 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 7 |
| Connecticut | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 2 | 3 | .... | .... | .... | .... | .... | .... | .... | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 3 |
| Dakota | .... | .... | .... | .... | 1 | 6 | .... | .... | 1 | .... | .... | 1 | 2 | 3 | .... | .... | .... | 1 | 2 | .... | .... | .... | .... | .... | .... | .... | .... | 1 | .... | 1 | .... | 11 |
| District of Columbia | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 |
| Florida | 6 | 4 | 3 | 2 | .... | 2 | 3 | 2 | 3 | 2 | 2 | 4 | 3 | 5 | 4 | 3 | .... | 1 | 1 | 2 | 1 | .... | 1 | 1 | 1 | 2 | 1 | .... | .... | .... | .... | 24 |
| Georgia | 2 | 2 | 2 | 2 | .... | .... | .... | 1 | .... | .... | 1 | .... | .... | 1 | .... | .... | .... | 1 | .... | .... | 3 | 4 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 10 |
| Idaho | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 |
| Illinois | 2 | .... | .... | .... | .... | .... | 5 | 5 | 1 | 2 | 1 | .... | .... | 3 | .... | 7 | .... | .... | .... | 1 | 7 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 10 |
| Indiana | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 3 | 1 | .... | .... | .... | 5 | 5 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 4 |
| Indiana Territory | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 2 | 1 | 2 | .... | .... | .... | 1 | .... | 2 | .... | 1 | .... | .... | .... | .... | .... | 1 | 1 | .... | .... | 8 |
| Iowa | .... | 1 | 5 | 8 | .... | 1 | 18 | 1 | 1 | 11 | 11 | .... | 1 | 12 | 6 | 2 | .... | .... | .... | 3 | 13 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 15 |
| Kansas | 1 | 2 | .... | .... | .... | 1 | 3 | .... | 1 | 2 | 3 | 7 | 2 | 2 | .... | .... | .... | 2 | 2 | 4 | 7 | 5 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 15 |
| Kentucky | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 | .... | .... | .... | .... | 2 | 2 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 3 |
| Louisiana | .... | .... | .... | 1 | .... | .... | .... | 1 | 1 | .... | .... | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | 5 |
| Maine | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | ..... |
| Maryland | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 | 1 | .... | .... | .... | 3 | .... | .... | .... | .... | 8 | .... | .... | 1 | .... | 9 | .... | .... | .... | .... | .... | 4 |
| Massachusetts | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 7 | .... | .... | .... | .... | .... | .... | 3 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 5 |
| Michigan | .... | .... | .... | .... | .... | .... | 4 | 5 | 1 | 2 | 8 | 3 | .... | .... | 4 | 9 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 3 | .... | 1 | 4 | .... | .... | 11 |
| Minnesota | .... | 2 | 2 | .... | 1 | 2 | 9 | .... | .... | 8 | .... | .... | 1 | 3 | 1 | 1 | .... | .... | .... | .... | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 10 |
| Mississippi | 2 | 1 | 1 | .... | 1 | .... | .... | .... | .... | .... | 1 | .... | 1 | .... | .... | .... | .... | .... | .... | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 7 |
| Missouri | .... | .... | .... | .... | .... | .... | .... | .... | 1 | .... | 1 | 1 | .... | 2 | 1 | .... | .... | .... | .... | .... | 3 | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 7 |
| Montana | .... | .... | 1 | .... | 1 | .... | .... | .... | .... | .... | .... | .... | 2 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 3 |
| Nebraska | .... | .... | .... | .... | .... | 1 | 2 | .... | 1 | 1 | 2 | 1 | .... | 1 | .... | .... | .... | .... | 1 | 3 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 9 |
| Nevada | .... | .... | .... | .... | .... | .... | .... | .... | 1 | .... | .... | 1 | 1 | .... | 1 | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | 1 | .... | 1 | .... | 1 | .... | 8 |
| New Hampshire | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 2 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 |
| New Jersey | .... | .... | .... | .... | .... | 1 | .... | 8 | .... | .... | .... | 2 | 3 | .... | .... | 2 | .... | 1 | .... | 2 | 2 | .... | .... | .... | .... | .... | .... | .... | 3 | 1 | .... | 10 |
| New Mexico | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 | .... | .... | .... | .... | .... | .... | 1 | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 3 |
| New York | .... | .... | .... | 2 | 1 | .... | .... | 1 | 1 | .... | .... | 5 | 3 | .... | .... | .... | 1 | 2 | .... | 6 | 3 | 1 | .... | .... | .... | .... | 3 | 1 | 2 | 3 | .... | 15 |
| North Carolina | 1 | 1 | 1 | 1 | .... | 1 | 2 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 2 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 7 |
| Ohio | .... | .... | .... | 3 | .... | .... | .... | .... | .... | .... | 1 | 7 | 1 | .... | 4 | .... | .... | .... | 1 | 3 | .... | .... | .... | .... | .... | .... | 1 | 1 | 3 | 2 | .... | 11 |
| Oregon | .... | .... | 1 | .... | .... | .... | .... | 1 | .... | .... | .... | 2 | .... | 3 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 2 | 5 | 7 | 1 | .... | 8 |
| Pennsylvania | .... | .... | .... | 1 | .... | .... | .... | 3 | 3 | .... | .... | 22 | 2 | .... | .... | 4 | .... | .... | 1 | 6 | 1 | .... | .... | .... | .... | .... | .... | 3 | 1 | 3 | .... | 12 |
| Rhode Island | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 |
| South Carolina | 3 | 2 | .... | 1 | 1 | 1 | .... | .... | 1 | .... | .... | .... | 1 | 1 | 1 | .... | .... | 1 | .... | .... | 2 | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 12 |
| Tennessee | .... | .... | 3 | 2 | .... | 1 | .... | .... | 1 | .... | .... | 1 | .... | 1 | 1 | .... | .... | .... | 1 | 1 | 2 | 2 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 11 |
| Texas | .... | .... | .... | .... | .... | .... | 3 | 6 | 5 | 4 | 3 | 5 | 2 | 3 | .... | .... | 1 | .... | .... | 5 | 1 | 2 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 12 |
| Utah | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 | .... | 3 |
| Vermont | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 | .... | .... | .... | .... | 1 | .... | .... | 6 | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 4 |
| Virginia | 3 | .... | .... | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | 1 | .... | .... | .... | .... | .... | .... | 4 |
| Washington | .... | .... | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 2 |
| West Virginia | .... | .... | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 2 |
| Wisconsin | .... | .... | .... | .... | .... | .... | 6 | .... | 1 | 6 | 4 | .... | .... | .... | .... | 1 | 1 | .... | .... | .... | .... | .... | .... | .... | 1 | .... | .... | .... | .... | .... | .... | 7 |
| Wyoming | 1 | .... | .... | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 3 |
| Number of States reporting | 13 | 11 | 12 | 15 | 11 | 13 | 11 | 12 | 17 | 11 | 17 | 18 | 23 | 17 | 13 | 13 | 8 | 14 | 10 | 19 | 18 | 13 | 3 | 3 | 5 | 4 | 5 | 9 | 7 | 9 | | |

## MISCELLANEOUS PHENOMENA.

### DROUGHT.

Chicago, Ill., 8th: reports from central and western Michigan state that the corn crop has been severely injured by the long drought.

Lamar, Mo., 10th: farmers report that the dry weather has been very injurious to the fall pastures.

Detroit, Mich., 12th: the continued drought has been very injurious in this part of the state, especially in Wayne, Oakland, and Macomb counties, the corn, of which there was an unusually large acreage this season, is burned and shriveled, with ears only partly matured; a general heavy rain fell in all sections of state on 15th, 16th, and 17th, breaking the drought.

Monument City, Huntington Co., Ind.: the rain which fell on the 15th was the first since the 2d of August; the dry weather has been very damaging to the agricultural interests in this section.

Moorhead, Minn., 17th: on account of the drought the ground has become so hard that farmers have been unable to commence plowing.

Huron, Beadle Co., Dak., 27th: farmers report that rain is very much needed for fall work, the ground has not been dry to such a great depth in nine years.

Tiffin, Seneca Co., Ohio, 30th: on account of the protracted drought, the Baltimore and Ohio Railway Company was running water trains during the first half of the month to different points west of this place.

### FOREST AND PRAIRIE FIRES.

Los Angeles, Cal., 7th: a large fire is reported in the Little Santa Anito Cañon, east of Sierra Madre.

Aberdeen, Brown Co., Dak., 7th: reports state that prairie fires are raging in McPherson and Edmonds counties; a large number of farmers have lost their farm houses and entire crops.

Escanaba, Mich., 12th: forest fires are burning at the edge of the town.

Deep River, Arenac Co., Mich., 12th: fires are reported along the Michigan Central Railroad, causing great damage to houses, fences, etc.

Standish, Arenac Co., Mich., 15th: forest fires are observed in all directions from this place.

Portland, Oregon, 15th: prairie fires are raging along the Columbia River northeast of this city; numerous homes of settlers and two or three railroad bridges have been burned.

Bismarck, Dak.: prairie fires burned over the entire south-

ern portion of Campbell county on the 20th; they were also burning north and east of this place on the 30th.

Huron, Dak., 27th: disastrous prairie fires are reported north of this place, especially in Faulk and Coteau counties.

McMinnville, Yamhill Co., Oregon, 30th: the sky has been darkened by smoke from forest fires in the surrounding country throughout nearly the entire month.

Webster, Day Co., Dak., 30th: prairie fires have been of general occurrence in this section during the month.

Forest and prairie fires were also reported during the month as follows: Red Bluff, Cal., 1st to 7th, 11th, 24th, 27th; Fort Assinaboine, Mont., 1st, 2d, 17th, 18th, 25th to 27th; Boisé City, Idaho, 2d, 15th, 17th, 21st, 25th; Green Bay, Wis., 6th; Poplar River, Mont., 9th; Fort Reno, Ind. T., 10th; Fort Canby, Wash., 11th, 14th; Deep River, Mich., 12th; San Diego, Cal., 14th to 16th; Port Huron, Mich., 16th; Fort Sill, Ind. T., 16th, 20th, 25th, 26th; Fort Sully, Dak., 24th, 30th; Jamestown, Dak., 27th; Ashland, Oregon, 27th to 29th.

### HALOS.

Solar halos were most frequently reported in New York and Tennessee, where they occurred on eleven days. In Illinois and Massachusetts they were noted on nine days. Over other sections of the country they were sparsedly distributed through the month, and to the westward of the one hundredth meridian none were noted, save in the northern plateau region and on the Pacific coast. The dates of greatest occurrence were the 3d, 6th, 25th, and 30th, and of the least the 1st and 27th. On the 23d no solar halos were reported. Lunar halos were observed with the greatest frequency in Mississippi, North Carolina, and Tennessee, where they were reported on eight dates. They were nearly as numerous in Illinois, New Jersey, South Carolina, and Virginia. Between the Mississippi Valley and the Pacific coast no lunar halos were reported, except in Nebraska, Nevada, and Arizona, where they were observed, respectively, on two dates. On the Pacific coast they were noted in California on two dates and in Oregon on one date.

The date of their most general occurrence was the 15th, when they were reported from fifteen states and territories. On the 1st, 2d, 3d, 5th to 7th, and 26th to 29th, no lunar halos were reported.

The phases of the moon, Washington mean time, during September, as given in "The American Ephemeris and Nautical Almanac," are as follows: new moon, 5th, 11h. 47.9m.; first quarter, 12th, 4h. 51.7m.; full moon, 19th, 12h. 16.1m.; last quarter, 27th, 15h. 22.0m.; perigee, 8th, 18.0h.; apogee, 24th, 14.0h.

### METEORS.

Meteors have been most frequently reported in southwestern Michigan, southern Minnesota, northern Ohio, Illinois, Tennessee, and Texas, where they occurred on from four to eight dates. Their distribution, by dates, over the remaining sections of the country was as follows: Eastern Massachusetts, 26th; central New York, 14th, 23d; Maryland, 20th; northeastern Florida, 2d, 4th, 24th; central Georgia, 9th; Indiana, 5th; Kentucky, 19th, 29th; Iowa, 26th; Louisiana, 18th, 19th; Dakota, 2d, 12th, 17th; Arizona, 23d, 24th; Oregon, 5th; California, Keeler, 2d, 10th, 12th, 21st.

The following are the more notable meteoric displays reported:

Liberty Hill, Bienville, Co., La.: a bright meteor was observed to pass from the zenith in a westerly direction at 8 p. m., 18th; it was sufficiently bright to cause trees and other objects to cast shadows. About two minutes after it had passed out of sight a loud report was heard, the concussion of which was sufficiently strong to cause houses to tremble at Sparta, sixteen miles west of this place.

Globe, Gila Co., Ariz.: a brilliant meteor was observed at 6.30 p. m., 23d; it moved from southeast to northwest, and remained visible ten to fifteen seconds.

Fort Thomas, Ariz.: a large meteor was observed at 8.20 p. m., 24th, moving from southeast to north; it remained in sight about five or six seconds, when it burst into fragments similar to a sky-rocket; no detonation was heard.

Marquette, Mich., 4th: a meteor of great brilliancy was observed in the western sky about 40° from the zenith, approaching the earth almost at a right angle; at a height of about 50° it moved parallel with the earth a distance of 10° and then burst into several pieces. The display lasted eight seconds.

Shreveport, La.: a brilliant meteor was observed in altitude 45°, moving from the southeast to a little west of south, at 8.45 p. m., 19th; it appeared about twice the size of an ordinary sky-rocket; its light was violet, changing to white, and lastly to pink. It is reported that the same meteor was seen in several places south of this city.

### MIRAGE.

Huron, Dak.: a distinct mirage was observed in all directions from sunrise until 9 a. m., 9th; villages ordinarily not visible at this place were clearly seen as though resting on slopes and hills of considerable elevation. This town appeared as though located in the centre of a natural basin of large area; Wessington Hills, a range of low elevation twenty-five miles distant, appeared as an elevated mountain range, trending from south to northwest, and assumed the peculiar tint of the Blue Ridge Mountains of Virginia and Tennessee; in fact the resemblance on account of various gaps and peaks was particularly striking.

Mirages were also observed as follows: Webster, Dak., 1st, 4th, 9th, 11th, 12th, 16th, 19th, 22d; Davenport, Dak., 2d, 4th, 9th, 28th, 29th; Woonsocket, Dak., 5th, 8th, 9th; Yuma, Ariz., 9th, 10th, 30th; Hampton, Iowa, 19th; Marquette, Nebr., 17th, 29th, 30th.

### SAND STORMS.

Sand storms were reported as follows:

Fort Grant, Ariz., 10th to 12th, 18th; Fort McDowell, Ariz., 17th; Yuma, Ariz., 17th, 21st; Fresno, Cal., 14th; Needles, Cal., 25th.

### SUN SPOTS.

Sun spots were observed during the month as follows:

John W. James, Reiley, McHenry Co., Ill.: two small spots first seen on the 7th on sun's meridan, vanished on the 12th or 13th. The large spot disappeared on the 9th, by the solar rotation, but failed to reappear when due on east edge. Another spot broke out east of sun's meridian on the 22d, disappearing by the solar rotation on the 28th.

H. D. Gowey, North Lewisburg, Champaign Co., Ohio: sun spots were observed from the 1st to the 14th, and from the 23d to the 28th, inclusive.

F. P. Leavenworth, director, Haverford College Observatory, Pa.:

| Date. September, 1888. | Number. | | Disappeared by solar rotation. | | Reappeared by solar rotation. | | Total number visible. | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| | Gr'ps | Spots | Gr'ps | Spots | Gr'ps | Spots | Gr'ps | Spots | |
| 12, 9 a.m.... | 4 | 24 | 0 | 0 | ..... | ..... | 4 | 24 | |
| 13, 10 a. m... | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 15 | |
| 14, 10 a. m... | 1 | 2 | 0 | 0 | 0 | 0 | 2 | 6 | |
| 18, 12 m..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 19, 4 p. m... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Through clouds. |
| 20, 10 a. m... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 21, 10 a. m... | 2 | 8 | 0 | 0 | ..... | ..... | 2 | 8 | |
| 21, 4 p. m... | 0 | 3 | 0 | 0 | 0 | 0 | 2 | 11 | |
| 22, 10 a. m... | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | |
| 24, 9 a. m... | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | |
| 26, 9 a. m... | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | |
| 27, 9 a. m... | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | |
| 28, 9 a. m... | 1 | 3 | 0 | 0 | 0 | 0 | 2 | 5 | |
| 30, 9 a. m... | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | |

The count of sun spots was made with a ten inch equatorial, with a telescope attachment, and is a continuation of the work done by Professor Todd at the Lawrence Observatory, Mass.

### REMARKABLE RAINBOW.

Capt. Samuel Hess, of the s. s. "Philadelphia," reports "that during the morning of September 22d, in N. 29° 20′, W. 70°

50′, with sun's altitude 19° 30′, bearing 94° E., observed a beautiful rainbow, concave, as usual, with apex at 65°, describing an arc of about 50°. In a few moments another bow made its appearance above the original one, of about the same size, but convex, the limbs making a perfect contact. A moment or two later a lesser bow made its appearance, convex, with an altitude of 40°. Barometer 29.92; air temperature 84°; wet bulb 76°; sea 84°; wind s. by e., force 3."

## VERIFICATIONS.

### INDICATIONS FOR 24 HOURS IN ADVANCE.

The percentages of verifications of the twice daily indications for September, 1888, as determined from comparison of succeeding telegraphic reports, are given in the table below.

The predictions for districts east of the Rocky Mountains for September, 1888, were made by 1st Lieutenant H. H. C. Dunwoody, 4th Artillery, Acting Signal Officer and Assistant, and those for the Pacific Coast districts were made at San Francisco, Cal., by 2d Lieutenant J. E. Maxfield, Signal Corps; the verifications for all districts were determined by Assistant Professor C. F. Marvin.

*Percentages of indications verified, September, 1888.*

| States. | | States. | |
|---|---|---|---|
| Maine | 83.3 | Tennessee | 90.6 |
| New Hampshire | 80.3 | Kentucky | 83.7 |
| Vermont | 80.3 | Ohio | 81.1 |
| Massachusetts | 80.5 | West Virginia | 78.7 |
| Rhode Island | 78.9 | Indiana | 83.3 |
| Connecticut | 76.1 | Illinois | 81.5 |
| Eastern New York | 81.5 | Lower Michigan | 82.1 |
| Western New York | 84.5 | Upper Michigan | 73.7 |
| Eastern Pennsylvania | 83.6 | Wisconsin | 81.3 |
| Western Pennsylvania | 80.5 | Minnesota | 82.0 |
| New Jersey | 81.1 | Iowa | 80.2 |
| Delaware | 80.1 | Kansas | 83.9 |
| Maryland | 77.6 | Nebraska | 83.9 |
| District of Columbia | 76.5 | Missouri | 78.2 |
| Virginia | 80.5 | Colorado | 87.1 |
| North Carolina | 85.9 | Eastern Dakota | 87.7 |
| South Carolina | 84.1 | Southern California | 84.4 |
| Georgia | 82.4 | Northern California | 85.3 |
| Eastern Florida | 85.1 | Oregon | 82.1 |
| Western Florida | 75.3 | Washington Territory | 82.6 |
| Alabama | 85.7 | *By elements:* Weather | 83.6 |
| Mississippi | 85.3 | Temperature | 79.4 |
| Louisiana | 79.9 | Monthly percentage of weather and temperature combined | 81.9 |
| Texas | 84.4 | | |
| Arkansas | 85.7 | | |

### CAUTIONARY SIGNALS FOR SEPTEMBER.

Statement showing percentage of justifications of wind signals for the month of September, 1888: Number of cautionary signals ordered, forty-nine; justified, twenty-six. Number of storm signals ordered, twelve; justified, eight. Number of signals ordered for easterly winds, thirty-three; justified as to direction, thirty. Number of signals ordered for westerly winds, twenty-seven; justified as to direction, twenty-five. Number of signals ordered late, three. Number of storms without signals, thirty. Percentage of justifications, 55.1. No cold-wave signals were ordered during the month.

### LOCAL VERIFICATIONS.

The following extracts from the published reports of the state weather services for September, 1888, show the percentages of verifications of weather and temperature signals:

*Indiana.*—Seymore: 78 per cent. of the indications were verified.

*Michigan.*—Weather signals are now displayed in one hundred and thirty-two towns, and upon the baggage-cars of twenty-six trains of eight of the principal railroads of the state.

The indications are issued at 10 p. m., daily, from the Chief Signal Office, Washington, and are for the twenty-four hours from 7 a. m. to 7 a. m.

The percentages of verifications of these indications for September are as follows (the verifications are taken from reports of displaymen furnished this office monthly): temperature, 81.4 per cent; weather, 79.4 per cent.; temperature and weather, 80.4 per cent.

Weather signals are displayed on the baggage-cars of the following railroads: C. & G. T. R'y; D., G. H., & M. R'y; D. D. G. T. R'y; M. C., main line and branches; C. & W. M. R'y; G. R. & I. R'y; P. H. & N. W. R'y; and the P. O. & P. A. R'y.

*Minnesota.*—The verifications of weather signals were 83 per cent. for weather and 82 per cent. for temperature.

*Nebraska.*—The percentages of correct weather predictions for the state were for temperature, 90.5; weather, 90.5; mean, 90.5.

*Ohio.*—The percentages of verification of weather signals received from Washington and distributed to thirty-two stations were seventy-nine for weather and eighty-seven for temperature.

*South Carolina.*—The percentages of verifications of weather and temperature predictions for the state were for weather, 85.0; temperature, 83.5.

## STATE WEATHER SERVICES.

The following extracts are republished from reports for September, 1888, of the directors of the various state weather services:

### ALABAMA.

During the first week rains were continuous in most sections of the state; the last half of the month, however, was comparatively dry and favorable for gathering the cotton that has been opening rapidly, particularly in middle and southern Alabama. The rainfall for the month has not been large—the average being only 0.86 of an inch above the normal—but the unusual precipitation in August made the rain in September injurious to most crops.

The temperature was 3°.9 below the normal, but no very decided cool spells occurred. The fall in temperature was gradual, with slight oscillations.

*Summary.*

*Temperature (in degrees Fahr.).*—Monthly mean, 72.4; highest monthly mean, 75.7, at Fort Deposit; lowest monthly mean, 65.7, at Gadsden; maximum, 90.5, at Montgomery, 11th; minimum, 35, at Gadsden, 30th; range for state, 55.5; greatest local monthly range, 58, at Valley Head; least local monthly range, 30, at Troy.

*Precipitation (in inches).*—Average for the state, 4.89; greatest, 9.96, at Talladega; least, 1.68, at Florence.

*Wind.*—Prevailing direction, northeast.—*P. H. Mell, jr., Signal Corps, Auburn, director.*

### ARKANSAS.

*Temperature (in degrees Fahr.).*—Monthly mean, 69.9; highest monthly mean, 77.5, at Malvern; lowest monthly mean, 63.9, at Conway; maximum, 97.0, at Lead Hill and Texarkana; minimum, 40.0, at Heber, Graham, and Little Rock; range for state, 57.0; greatest local monthly range, 57.0; least local monthly range, 22.0, at Dallas.

*Precipitation (in inches).*—Average for the state, 1.01; greatest, 2.35, at Devall's Bluff; least, 0.25, at Graham.—*Prof. John C. Branner, Little Rock, director; W. U. Simons, Signal Corps, assistant.*

### ILLINOIS.

The temperature was equable, but lower than the average of corresponding months in previous years. There were no very cold, neither were there any hot days. The warmest days were the 8th, 9th, and 10th, and the coldest the 28th and 29th; at no time did the temperature of the air fall below the freezing point, except in the extreme north on the 29th. There were several light frosts, and a killing one on the 29th, but no damage was done to vegetation.

The average temperature for the state was 62°.0, which was 4°.4 below the average of the past ten years. Only once during that period, in 1879, has the monthly mean been lower, when it was 61°.7.

This deficiency of average temperature was evenly distributed over the state; in the northern and central divisions the deficiency was the same—4°.1, while in the southern it was 4°.8. The maximum temperature was about the average, but the minimum was lower than at any time during the past ten years.

The rainfall has, also, been much below the average of previous years. At only two stations—Peoria and Griggsville—was an excess reported. The monthly average was 1.83 inches below that of the past ten years, and was less than that of any September except in 1883, when it was 1.21 inches.—*Col. Charles F. Mills, Springfield, director; James Cassidy, Signal Corps, assistant.*

### INDIANA.

Cool temperatures prevailed throughout the month, and the mean was nearly 5° below the normal. September, 1871, was as cool as the past month, and September, 1879, only was slightly cooler. The highest temperatures were noted at most stations on the 8th and 11th, and the lowest on the passage of the highest barometric area on the 29th and 30th; at many places heavy killing hoar-frost and ice formed on the mornings of these dates. Abrupt changes in temperature were of rare occurrence, the most noteworthy occurring on the 30th, with the rapid approach of a low barometric area during the latter part of the day, when the temperature rose rapidly, with a sudden fall in barometer.

The precipitation was small, except in the southeast portion of the state, where heavier rains occurred. During the first half of the month but little rain fell, and the number of rainy days was small. The least rain fell in the